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(21) International Application Number: PCT/NO98/00083 (22) International Filing Date: 13 March 1998 (13.03.98) (30) Priority Data: 971221 17 March 1997 (17.03.97) NO (71)(72) Applicant and Inventor: FORBERG, Halvor [NO/NO]; Hegdal, N-3261 Larvik (NO). (74) Agent: REISTAD, Gunnar, O.; Bryns Patentkontor A/S, Postboks 765 Sentrum, N-0106 Oslo (NO).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Norwegian).</i>
(54) Title: METHOD OF STERILISING GRANULATE AND PARTICULATE MATERIAL AND MEANS IN A MIXING APPARATUS (57) Abstract <p>When sterilising a granulate or particulate material, steam is added to the material in order to heat it to sterilisation temperature and the material is maintained at that temperature for a necessary residence time. The material is agitated to a fluid state in the first chamber whilst it is heated by a supply of steam. After agitation and heating, the material is passed directly into a residence vessel from where the material is discharged after a desired residence time. The sterilisation is carried out in a plant which includes a housing (4), an intake opening (5) in the housing, a discharge opening (6, 7) in the housing and agitator means (2, 3) provided inside the housing for fluidising a granulate or particulate material. The housing (4) has an inlet (13) for the supply of steam to the material in the housing, and the housing discharge opening (6, 7) is attached to a vessel (10) for receiving material from the housing (4) through the discharge opening (6, 7). In a bottom region thereof, the vessel (10) has a discharge means (11) for the material in the vessel. The plant is insulated and/or heated.</p>		

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Method of sterilising granulate and particulate material and means in a mixing apparatus

The invention relates to a method of sterilising granulate and particulate material,
5 wherein steam is added to the material to heat it to sterilisation temperature and the material is maintained at this temperature for a necessary residence time.

The invention has been especially developed in connection with the need to render harmless salmonella bacteria in animal feed. Salmonella has become a growing
10 problem which has resulted in long-term sick leave and at times even a fatal outcome. The problem has now grown to such proportions that the EU has directed that all animal feed is to be heated to a minimum of 80°C. From research into the problem complex, it is known that heating to a temperature of 80°C without a residence time will not render the salmonella bacteria harmless, as this requires a combination of temperature,
15 moisture and residence time.

Eggs are a major source of salmonella infections. The problem has now become so great that in many places on the continent it is not possible to buy soft-boiled eggs or fried eggs as the heat treatment of the yoke is inadequate. Similarly, meat may be
20 infected with salmonella and the consumption thereof may have a disabling result.

Today, researchers have identified 2000 variants of salmonella bacteria ranging from the relatively harmless to the deadly.

25 Today's equipment in animal feed factories is not capable of handling the required sterilisation, i.e., the directive that all feed must be heated to a minimum temperature of 80°C and kept at this temperature for a sufficient period of time.

A short residence time requires high temperature and adequate moisture. In this case,
30 the temperature typically may be 120°C. The costs of generating this temperature are very high, both in terms of running costs and in the purchasing of equipment. Today it is typical to use expanders or extruders for this part of the process, and this is very costly and energy-consuming.

35 The high temperature damages a part of the grain (feed), which becomes difficult to digest. Other parts of the grain become easier to digest, but this may again be achieved

by using a lower temperature for a longer time without the damaging side-effects that the high temperature causes.

Thus, there is a need to find a simpler way to "sterilise" animal feed than the methods used today, both as regards operations and in terms of investments.

Researchers have asserted that even a temperature as low as 71°C and a residence time of three minutes, combined with 16 to 17% moisture in the product, will effectively kill salmonella.

10

According to the invention, a method is proposed as mentioned above, characterised in that the granulate and particulate material is agitated to a fluid state whilst being heated by a supply of steam, and that after agitation and heating the material is passed directly into a residence vessel from where the material is discharged after the desired residence time.

15

When agitating the material to a fluid state, as is known from a mixing apparatus commonly used in animal feed factories, and which may be one of various kinds, it will be possible to reach a sufficiently high temperature, e.g., 90-95°C, by introducing steam. The transfer to a residence vessel ensures necessary residence time for complete destruction of salmonella bacteria in particular.

20

One particular advantage of the invention is that the method can be carried out in connection with already existing equipment, modified in a very simple manner (procurement of a residence vessel and insulation of existing mixing plant).

25

It is especially advantageous to use overheated steam.

Similarly, it may be advantageous if, after agitation and heating, the material is gravity-transferred directly to the residence vessel.

30

The invention also relates to a means in a mixing apparatus, which mixing apparatus includes a housing, an intake opening in the housing, a discharge opening in the housing and agitator means provided inside the housing for fluidising a granulate or particulate material.

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A mixing apparatus of this kind is a common piece of equipment in feed factories, where a typical diagram would be a weighing system, a mixing apparatus, a receptacle, an elevator to a silo, a conditioning system and a pellet press.

- 5 According to the invention, it is proposed that the housing should have an inlet for the supply of steam to the material in the housing, and that the housing discharge opening should be attached to a vessel for receiving material from the housing through the discharge opening.
- 10 The said material receiving vessel can be used as a residence vessel in connection with the sterilisation of the feed by means of heating to a sterilisation temperature by supplying steam to the mixing apparatus, where the granulate or particulate material is agitated to a fluid state in connection with the mixing that takes place therein. In terms of costs, the invention will result in great advantages for animal feed factories and the
- 15 like, since existing space in the factory can be used. The vessel is very simply arranged under the mixing apparatus. Moreover, the invention also means that silos before cascade mixers and pellet presses can be dispensed with. The cascade mixer on the pellet press may be dispensed with, and thus overall in terms of investments the sum required is lower than today's investment, and in addition the requisite protection
- 20 against salmonella is obtained. If such protection is to be obtained by using the plants common in feed factories today, a major investment must be made in expanders or extruders in order to elevate the temperature sufficiently, because a prolonged residence time cannot be used. The running costs would be very high in such a case.
- 25 The invention will help considerably to reduce investments. Since, in today's plants the product is already heated, the energy used for this will be channelled into the mixing apparatus/conditioning and will involve only slightly higher costs related to a somewhat higher temperature, but considerably lower costs for heating than, e.g., expanders which supposedly raise the temperature of the product to 120°C, which in turn requires higher
- 30 costs in order to bring the temperature back down to ambient temperature.

According to the invention, the vessel advantageously has a discharge device in the bottom region thereof. The discharge device may be a horizontal feed screw and may to advantage be progressive, in order thereby to maintain a desired horizontal free surface

35 for the material in the residence vessel.

According to the invention, it is advantageous if both the housing and the vessel are thermally insulated, or have external heating or a combination of both.

5 The steam inlets are advantageously located according to the invention in a lower portion of the housing.

Agitator means may include two interacting horizontal paddle rotors.

10 It is especially advantageous according to the invention if the volume of the vessel is larger than that of the housing. It is particularly advantageous if the volume of the vessel is at least 1.7 times that of the housing.

The invention will now be described in more detail with reference to the schematic drawings, wherein:

15

Fig. 1 is a vertical section through a means according to the invention; and
Fig. 2 is a vertical section 90° to the section in Fig. 1.

20 The drawings show a mixing apparatus 1 having two horizontal paddle units 2, 3 in the apparatus housing 4. The mixing apparatus 1 may, for example, be of the general type that is described in EP 219471. A mixing apparatus of this kind has two horizontal motor-powered shafts provided with blades or paddles which beat the granulate or particulate material with which the housing 4 is filled, and fluidise the product during a mixing process.

25

The mixing apparatus 1 has an intake opening 5 and two discharge openings 6, 7 in the bottom region. The discharge openings 6, 7 can be opened and closed by means of sluices 8, 9 which in Fig. 1 are indicated with broken lines and are swung down into an open discharge position so that the product poured into the housing 4 through the intake
30 opening 5 can, after mixing, be discharged through the discharge openings 6, 7.

In direct connection with the lower part of the mixing apparatus around the discharge openings 6, 7 there is provided a residence vessel 10 into which the product processed in the mixing apparatus 1 can fall straight down, through the opened discharge openings
35 6, 7.

The residence vessel 10 has a funnel-shaped lower region wherein at the bottom there is provided a progressive feed screw 11 which conveys the product out of the residence vessel 10 through an opening 12.

- 5 The mixing apparatus 1 is provided with a plurality of steam nozzles 13 through which steam can be fed into the mixing apparatus. These steam nozzles are arranged advantageously in the lower region of the mixing apparatus beneath the agitators 2, 3.

The plant in the drawings functions in the following manner. The granulate or
10 particulate material (not shown) is fed into the mixing apparatus 1, 4 through the intake opening 5. The sluices 8, 9 are closed. The agitators 2, 3 are used to provide an agitation of the filled material in order to mix it in a commonly known manner. During the mixing a fluidisation of the granulate or particulate material is produced. Steam is introduced through the nozzles 13 to heat the fluidised material. The introduction of
15 steam also means that desired moisture is added to the material in the mixing apparatus.

When mixing and sufficient heating for sterilisation have been accomplished, the agitators 2, 3 are stopped and the discharge openings 6, 7 are opened. The material in the mixing apparatus will then fall straight down into the vessel 10. The sluices 8, 9 are
20 closed. A fresh quantity of product can then be poured into the mixing apparatus for mixing and sterilisation. The product that has been transferred to the vessel 10 will remain in the vessel 10 for a period of time necessary to obtain of the requisite sterilisation. After the desired residence time in the vessel, the product is conveyed out through the opening 12 by means of feed screws 11 and preferably concurrently with the
25 product material which comes from the mixing apparatus.

The plant may to advantage be insulated, as indicated by means of the reference numeral 14, and optionally external heating (not shown) may also be provided, in addition to or instead of insulation. The heating may, for example, take place
30 electrically or by using a steam loop.

The invention provides the advantage that it is possible to use a mixing apparatus which is already an integrated part of a feed production and which exists in several different types. The only departure is that the apparatus should be insulated and partly heated to
35 avoid cold surfaces which may cause the salmonella bacteria to survive. Similarly, a vessel 10 must be provided where the product can be kept for a minimum of three minutes, so that the necessary residence time in the system is obtained. In the plant

according to the invention, it is possible in a simple manner to obtain a desired temperature, residence time and moisture in order to satisfy the requirements made with respect to a sterilisation of the feed product.

- 5 As mentioned, the mixing apparatus may be one of many different types. The requirement is that it must be capable of fluidising the product, so that a very efficient mixing of the steam into the feed or product is achieved, in order thereby to obtain the sufficient, uniform temperature increase in the product.
- 10 It is advantageous to provide a level control in the vessel 10, which prevents the vessel from being emptied to a level that is too low before the next quantity arrives from the mixing apparatus, or alternatively prevents the quantity added from entering too soon before the vessel has been sufficiently emptied. This is to guarantee a correct residence time in the system.
- 15 The steam may be overheated to better balance the quantity of moisture which is added to the product.

P a t e n t c l a i m s

1.

- 5 A method of sterilising a granulate or particulate material wherein steam is added to the material in order to heat it to sterilisation temperature in a chamber and after heating is transferred directly to a second chamber and is maintained therein for a necessary residence time before discharge, characterised in that a quantity of material is agitated to a fluid state in the first chamber whilst it is heated by a supply of steam, and that after
10 heating the quantity of material is made to fall straight down into the second chamber.

2.

- A means in a mixing apparatus, which mixing apparatus includes a housing (4), an intake opening (5) in the housing, a discharge opening (6, 7) in the housing and agitator
15 means (2, 3) provided inside the housing for fluidising a granulate or particulate material, characterised in that the housing (4) has an inlet (13) for the supply of steam to the material in the housing, and that the housing discharge opening (6, 7) is attached to a vessel (10) for receiving material from the housing (4) through the discharge opening (6, 7).

20

3.

- A means according to claim 2, characterised in that the vessel (10) in a bottom region thereof has a discharge means (11) for the material in the vessel.

25 4.

- A means according to claim 3, characterised in that the discharge means (11) is a horizontal feed screw.

5.

- 30 A means according to claim 4, characterised in that the horizontal feed screw (11) is progressive.

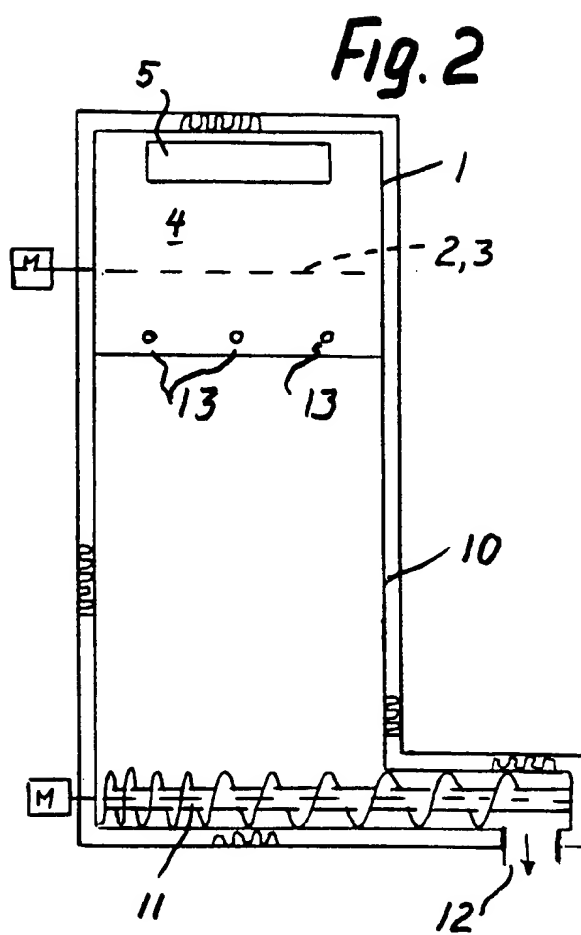
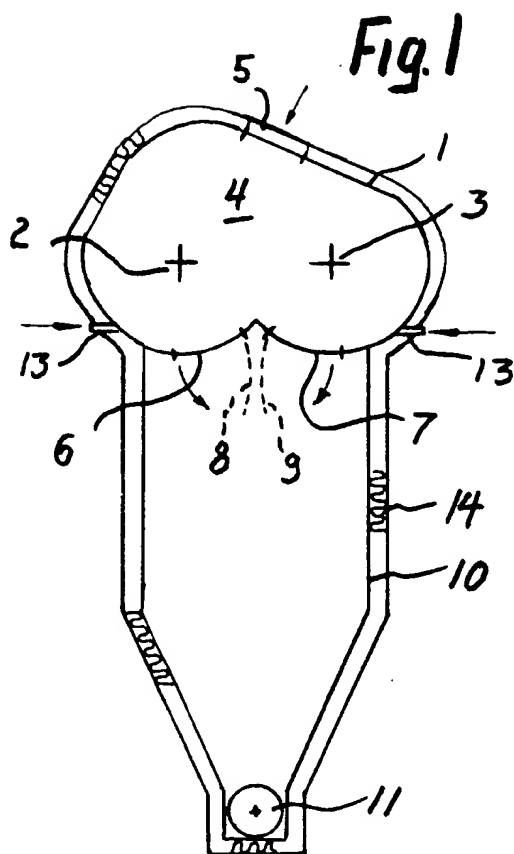
6.

- A means according to one of the preceding claims 2-5, characterised in that the agitator
35 means (2, 3) include two interacting horizontal paddle rotors.

7.

A means according to one of the preceding claims 2-6, characterised in that the volume of the vessel (10) is greater than the volume of the housing, preferably at least 1.75 of
s the volume of the housing.

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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61L 2/06, A23K 1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61L, A23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 4059919 A (JOSEPH GREEN), 29 November 1977 (29.11.77), claims 1-3 --	1-7
A	US 4161139 A (FRANCISCUS VAN DEUREN), 17 July 1979 (17.07.79) --	1-7
A	EP 0622085 A1 (DAISEY KIKAI CO., LTD.), 2 November 1994 (02.11.94), Claims --	1-7

☒ Further documents are listed in the continuation of Box C.
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Swedish Patent Office

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Facsimile No. +46 8 666 02 86

Authorized officer

Anneli Jönsson

Telephone No. +46 8 782 25 00

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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